Twin Metals Dry Stack Tailings Storage 101

Dry stacking is the most sustainable method used to store filtered tailings—silty, sandy material— produced from the mine processing plant after the 4% of the ore that is copper, nickel and other metals is extracted. Tailings stored in dry stacks are piles of sand topped by native soil and vegetation. There is no need for a dam to hold them in place, no possibility of dam failure, and no long-term storage issues. Due to the deposit's geology, tailings will be non-acid generating. These tailings can be safely exposed to air and water because all but trace amounts of sulfides will be removed from them during processing.

The process begins with large rocks crushed, ground and mixed into a slurry of water and fine rock particles. The sulfides contained in the rocks are separated and recovered into concentrates through a flotation process and prepared for shipment to customers. The residual crushed rock, or tailings, and water are then filtered and separated. The water is recycled back into the processing plant.

At Twin Metals' underground mine, the filtered tailings, by now the consistency of sand castle sand, will be transported to the dry stack area near the processing plant. That area will include a gravity drainage system to collect whatever moisture remains in the tailings into reclaim ponds, which will be recycled back into the processing plant. The dry stack material will be compacted to ensure stability, and the stack will average around 120 feet, consistent with the topography of the area.

BENEFITS

- Stable structure means no dam, and no possible tailings dam failure
- The water generated from the filtering process to create the dry stack material is recycled to the processing plant (closed loop).
- Stacked tailings will be placed on a liner, reclaimed on top with native soil and vegetation
- Tailings will be reclaimed in stages, not all at once – a process called progressive reclamation
- Significantly smaller footprint than conventional wet tailings storage

FIGURE 1

FIGURE 2

FIGURE 3

Figure 1 shows the start of placement and compaction of material in a designated portion of the dry stack area. Once the area reaches capacity, reclamation begins while placement and compaction begin in the next area. Figure 2 shows a partially reclaimed section of a dry stack site adjacent to an active stacking area. Figure 3 shows the long-term results of a reclaimed dry stack facility.

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Other Key Environmental Points

- **State and federal environmental review:** Prior to permitting, mines such as TMM's must pass strict regulatory approvals covering a host of protections through mine construction, ongoing operation and closure. This includes water and air quality, noise, views, drinking water supply, wetlands, generation and storage of hazardous and non-hazardous waste, endangered species, plant life and cultural resources.

- **No acid rock drainage:** The geology of the Maturi Deposit, as well as the way that Twin Metals proposes to mine this resource, allows for the production of non-acid generating tailings. The sulfides in the rock are extracted, concentrated and shipped to customers. At the Twin Metals mine, up to 50% of tailings will have cement added and permanently placed back underground, with minimal exposure to air or water. Testing has shown these to be non-acid generating when exposed to air or water. Nonetheless, the surface dry stack facility will have an engineered liner at the base and when reclaimed, will be covered with native soils and vegetation to protect against seepage.

- **Best practices followed:** Underground mining has minimal surface impacts; underground storage of approximately half of the tailings; no permanent waste rock stockpiles on the surface; water reuse in ore processing; infrastructure designs to minimize potential impacts on wetlands.

- **Subsidence prevention:** Design features of the underground mine will prevent subsidence, or vertical shifting of the ground caused by failure of an underground mine beneath the surface. The mine, as deep as more than 4,000 feet below the surface, will have a crown pillar of solid rock at least 400 feet thick between the surface and the ceiling of the mine. In addition, solid pillars of unmined rock will be left in place for structural support between the mined spaces, called stopes. Plus, as noted above, roughly half of the tailings produced will be returned underground, backfilled and cemented to provide still more structural support.

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